Course Introduction

Hello! And welcome to this capstone course.

Congratulations for making it this far! My name is Joseph Santarcangelo, Yan Luo and Azim Hirjani . We are pleased to be your instructors and course developers for this capstone course. You will apply your data science skills as a Data scientist for a private space launch company in this project.

As a starting point of almost all data science projects, you need to collect data, as much and relevant as possible.

You will be collecting data from various sources. After your raw data has been collected, you will need to improve the quality by performing data wrangling.

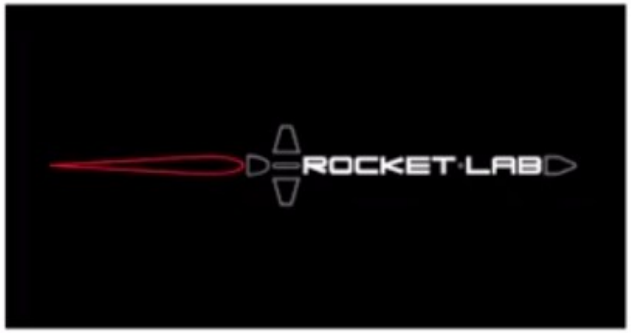
Then you can start exploring the processed data. We will be your guide as we explore some really interesting real-world datasets together. You'll get to practice your SQL skills as we query the data and gather insights.

You'll gain further insights into the data by applying some basic statistical analysis and data visualization, you'll be able to see directly how variables might be related to each other.

We'll drill down into finer levels of detail by splitting the data into groups defined by categorical variables or factors in your data.

Project Scenario and Overview

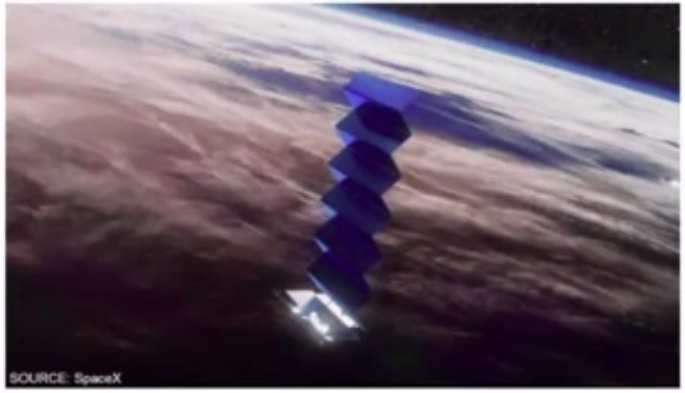
IBM Developer



BLUE ORIGIN

SPACEX

www.flickr.com



Source Space X

Source NASA

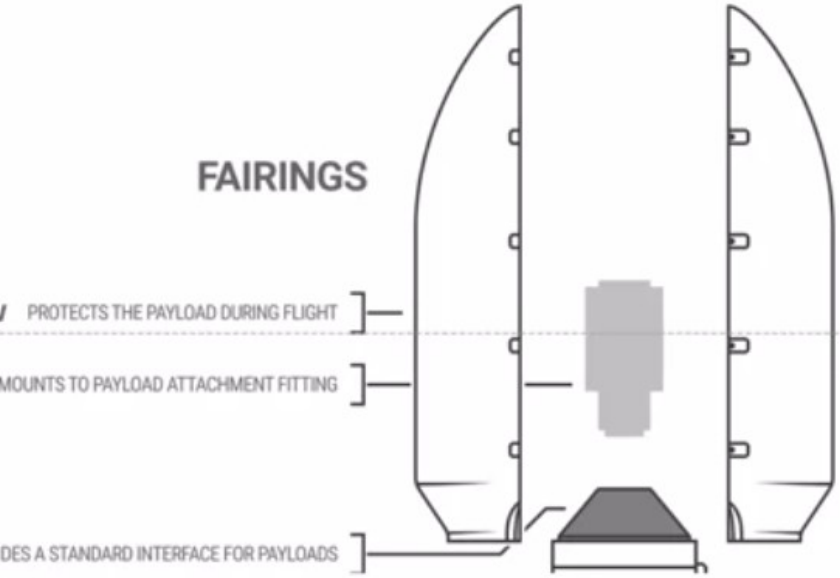

LIVE
NBC NEWS
NOW

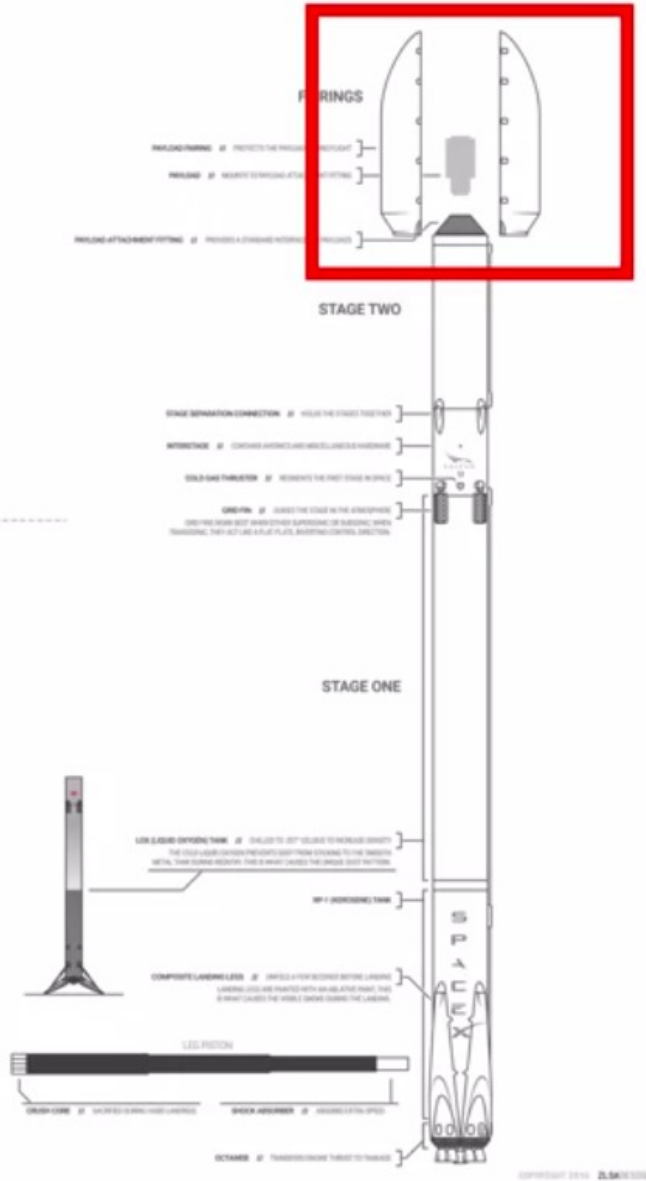
FAIRINGS

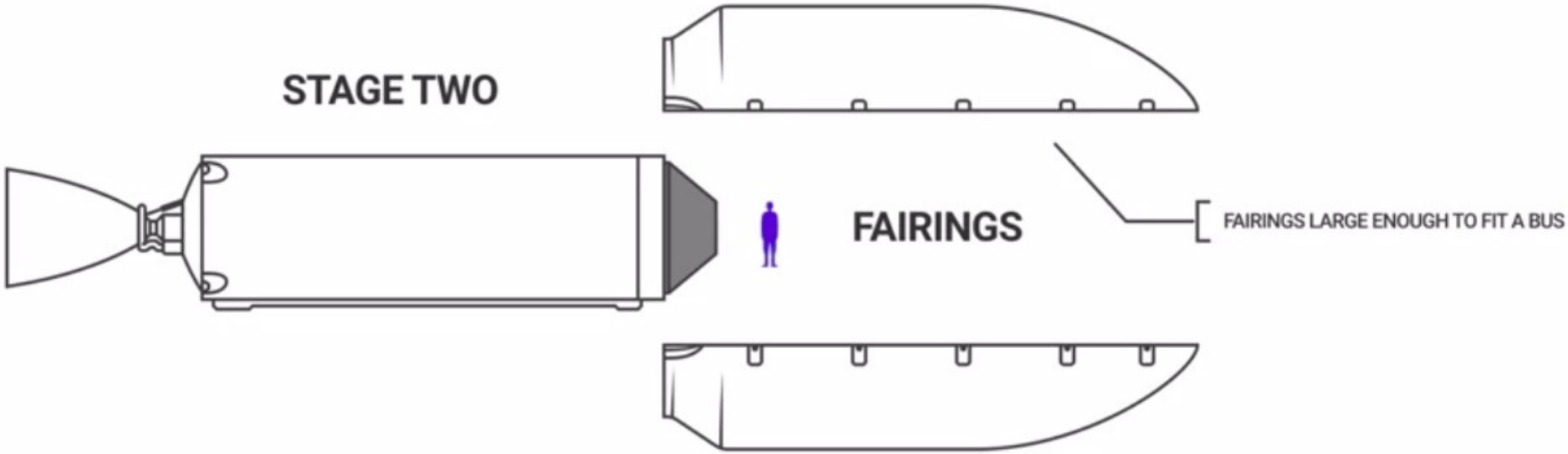
PAYLOAD FAIRING // PROTECTS THE PAYLOAD DURING FLIGHT

PAYLOAD // MOUNTS TO PAYLOAD ATTACHMENT FITTING

PAYLOAD ATTACHMENT FITTING // PROVIDES A STANDARD INTERFACE FOR PAYLOADS

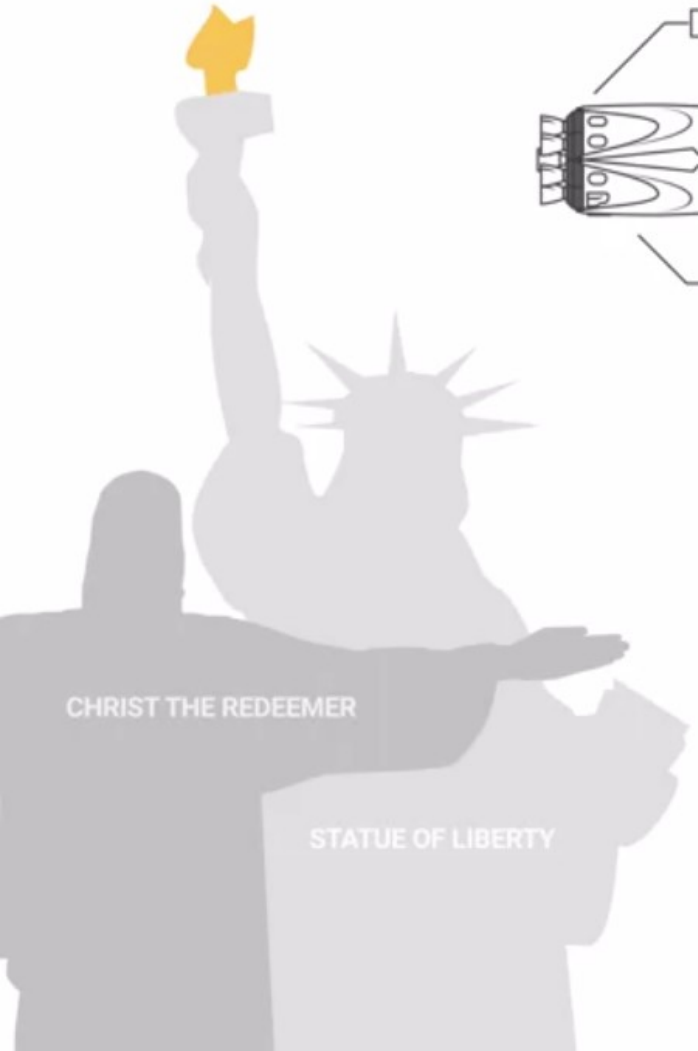





STAGE TWO
FAIRINGS
FAIRINGS LARGE ENOUGH TO FIT A BUS

SpaceX Falcon 9 // SCALE AND TRANSPORTATION

* AS OF JUNE 2016



OCTAWEB // DURING TRANSPORT, THE OCTAWEB IS MOUNTED TO THE TRAILER

INTERSTAGE // FACES FORWARDS DURING TRANSPORT

STAGE ONE

GRID FINS // EACH HOLE IS BIG ENOUGH TO FIT A HUMAN ARM

LANDING LEG // NEARLY THE SIZE OF THE FALCON 1

THE LANDING LEGS ARE TRANSPORTED INDEPENDENTLY TO THE LAUNCH SITE AND INSTALLED ON THE STAGE THERE.

TESLA MODEL S // FOR SCALE

RESIDENTIAL DOOR // FOR SCALE

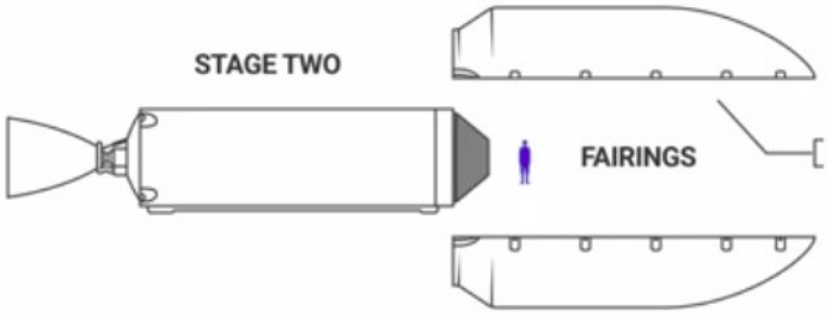
BANANA // FOR SCALE

IS THIS STILL A THING?

ALL OF THE COMPONENTS FOR THE FALCON 9 ARE SHIPPED TO THE LAUNCH SITE ON U.S. HIGHWAYS. THE FALCON 9 WAS DESIGNED FROM THE START TO FIT U.S. ROADS.

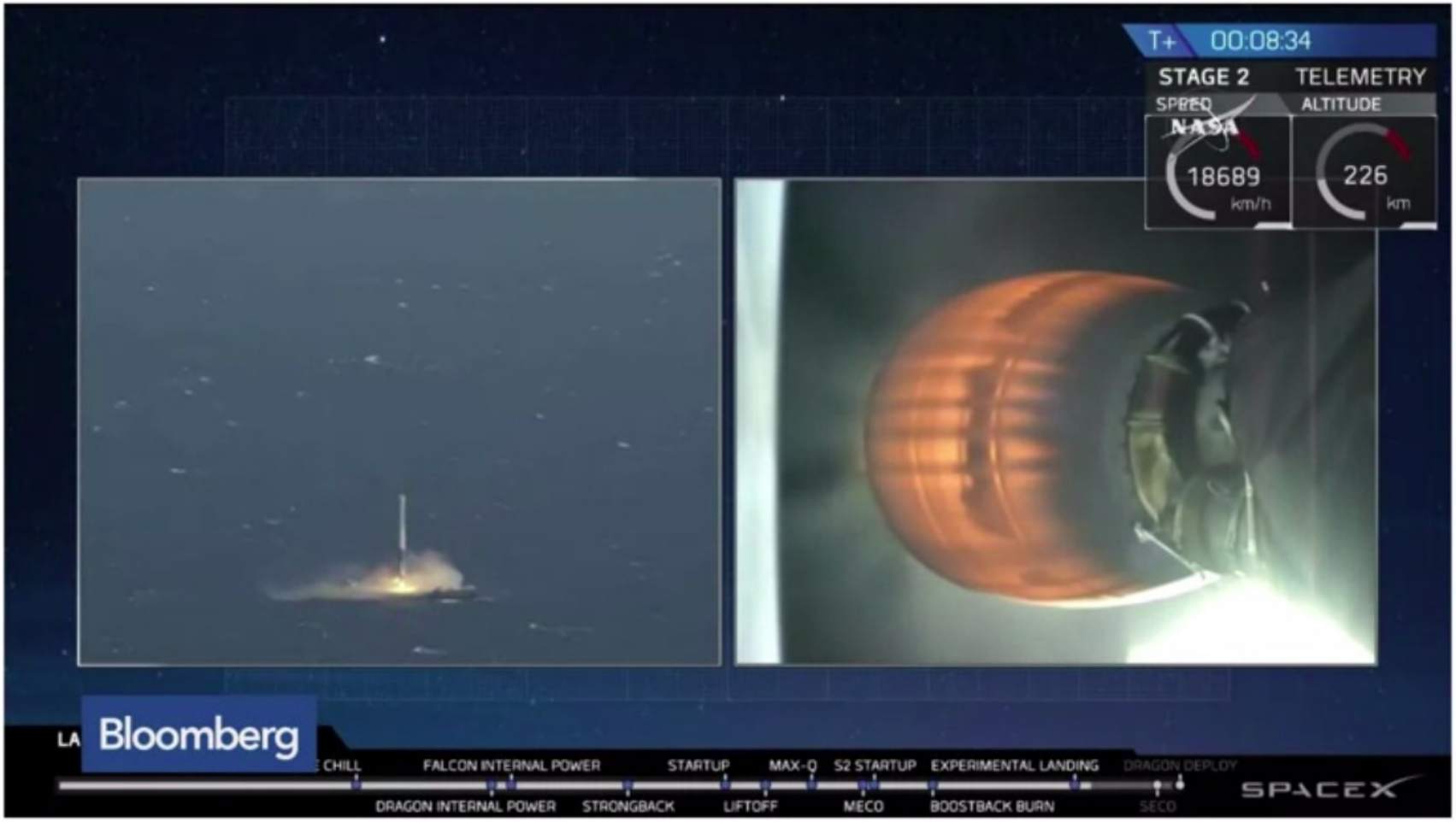
DURING THE TRANSPORTATION OF FALCON 9 STAGES, THEY ARE PRESSURIZED WITH NITROGEN AND COVERED IN A CUSTOM-MADE BLACK PLASTIC WRAP TO KEEP THEM CLEAN AND FREE OF FOREIGN OBJECTS.

STAGE TWO



FAIRINGS

FAIRINGS LARGE ENOUGH TO FIT A BUS


T+ 00:08:34
STAGE 2 TELEMETRY
SPEED
ALTITUDE
NASA
18689
km/h
226
km
Bloomberg
CHILL
FALCON INTERNAL POWER
STARTUP
MAX-Q
S2 STARTUP
EXPERIMENTAL LANDING
DRAGON DEPLOY
DRAGON INTERNAL POWER
STRONGBACK
LIFTOFF
MECO
BOOSTBACK BURN
SECO
SPACEX

SPACE Y

Allon Mask

Photo based on Photo by **Britta Pedersen-Pool/Getty Images**

When a fluid flow through a varying conduit, the conservation of mass states :

$\dot{m} = \rho \cdot A \cdot v = const.$ [1]

Newtons second law can be utlilized to describe a steady fluid particle flow, leading to the famous Bernoulli equation (assuming no friction) :

$dp + 0.5 \cdot \rho \cdot d(v^2) + \gamma \cdot dz = 0$ [2](const. along a stream line)

where :

p : pressure, ρ : density, v : speed, γ : specific weight $(\rho \cdot g)$ and z : height

Since we assume no potential change and one - dimensional flow, eq. 2 can be written as :

$$\frac{dp}{\rho \cdot v^2} = -\frac{dv}{v}$$ [3]

Before proceeding we now take the natural logaritm of eq.1 :

$\ln \rho + \ln A + \ln v = \text{const.}$

Differenta ting the above expression :

$$\frac{d\rho}{\rho} + \frac{dA}{A} + \frac{dv}{v} = 0$$

or

$$-\frac{dv}{v} = \frac{d\rho}{\rho} + \frac{dA}{A}$$ [4]

Rockets and how they work By Jan-Erik Rønningen
Norwegian Rocket Technology

Collecting the Data

SpaceX REST API

SpaceX REST API

Open Source REST API for launch, rocket, core, capsule, starlink, launchpad, and landing pad data.

build passing | docker pulls 2.1M | release v4.0.0 | interface RFST

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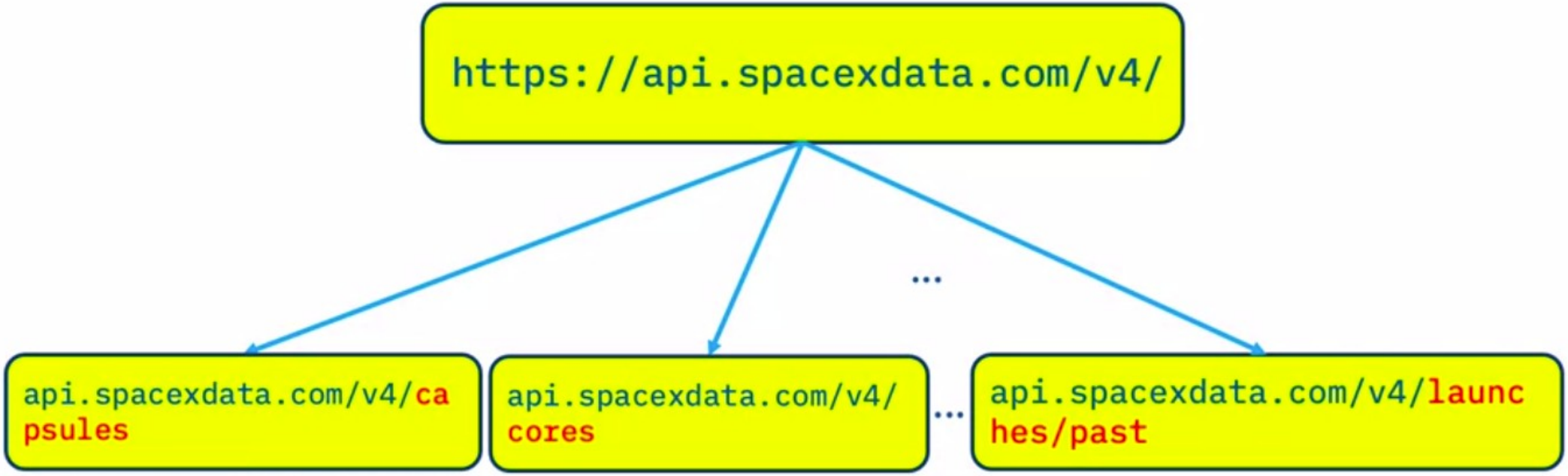
https://github.com/r-spacex/SpaceX-API


https://api.spacexdata.com/v4/
...
api.spacexdata.com/v4/capsules
api.spacexdata.com/v4/cores
...
api.spacexdata.com/v4/launches/past
'[{"reuse_count":0,"water_landings":1,"land_landings":0,"last_update":"Hanging in atrium at SpaceX HQ in Hawthorne","launches":["5eb87cdeffd86e000604b330"],"serial":"C101","status":"retired","type":"Dragon 1.0","id":"5e9e2c5bf35918ed873b2664"},{"reuse_count":0,"water_landings":1,"land_
'[{"block":null,"reuse_count":0,"rtls_attempts":0,"rtls_landings":0,"asds_attempts":0,"asds_landings":0,"last_update":"Engine failure at T+33 seconds resulted in loss of vehicle","launches":["5eb87cd9ffd86e000604b32a"],"serial":"Merlin1A","status":"lost","id":"..

```
url="https://api.spacexdata.com/v4/launches/past"

response =requests.get(url)

response.json()
```

```
response.json()
```


```
[{'fairings': {'reused': False,
   'recovery_attempt': False,
   'recovered': False,
   'ships': []},
  'links': {'patch': {'small': 'https://images2.imgbox.com/3c/0e/T8iJcSN3_o.png',
    'large': 'https://images2.imgbox.com/40/e3/GypSkayF_o.png'},
   'reddit': {'campaign': None,
    'launch': None,
    'media': None,
    'recovery': None},
   'flickr': {'small': [], 'original': []},
   'presskit': None,
   'webcast': 'https://www.youtube.com/watch?v=0a_00nJ_Y88',
   'youtube_id': '0a_00nJ_Y88',
   'article': 'https://www.space.com/2196-spacex-inaugural-falcon-1-rocket-lost-launch.html',
   'wikipedia': 'https://en.wikipedia.org/wiki/DemoSat'},
  'static_fire_date_utc': '2006-03-17T00:00:00.000Z',
  'static_fire_date_unix': 1142553600,
  'tbd': False,
  'net': False,
  'window': 0,
  'rocket': '5e9d0d95eda69955f709d1eb',
  'success': False,
  'details': 'Engine failure at 33 seconds and loss of vehicle',
  'crew': [],
  'ships': [],
  'capsules': [],
  'payloads': ['5eb0e4b5b6c3bb0006eeb1e1'],
  'launchpad': '5e9e4502f5090995de566f86',
  'auto_update': True,
  'failures': [{'time': 33,
    'altitude': None,
    'reason': 'merlin engine failure'}],
  'flight_number': 1,
  'name': 'FalconSat',
  'date_utc': '2006-03-24T22:30:00.000Z',
  'date_unix': 1143239400,
  'date_local': '2006-03-25T10:30:00+12:00',
  'date_precision': 'hour',
  'upcoming': False,
  'cores': [{'core': '5e9e289df35918033d3b2623',
    'flight': 1,
    'gridfins': False,
    'legs': False,
    'reused': False,
    'landing_attempt': False,
    'landing_success': None,
    'landing_type': None,
    'landpad': None}],
  'id': '5eb87cd9ffd86e000604b32a'},
 {'fairings': {'reused': False,
   'recovery_attempt': False,
   'recovered': False,
   'ships': []},
  'links': {'patch': {'small': 'https://images2.imgbox.com/4f/e3/I0lkuJ2e_o.png',
    'large': 'https://images2.imgbox.com/be/e7/iNqsqVYM_o.png'},
   'reddit': {'campaign': None,
    'launch': None,
    'media': None,
    'recovery': None},
   'flickr': {'small': [], 'original': []},
   'presskit': None,
   'webcast': 'https://www.youtube.com/watch?v=Lk4zQ2wP-Nc',
```


IBM **Developer**

Wrangling Data using an API

```
data = pd.json_normalize(response.json())
```

	static_fire_date_utc	static_fire_date_unix	tbd	net	window	rocket	success	details	crew	ships	capsules	payloads	launchpad	auto_update	failures	flight_number	name	date_utc	date_unix
0	2006-03-17T00:00:00.000Z	1.142554e+09	False	False	0.0	5e9d0d95eda69955f709d1eb	False	Engine failure at 33 seconds and loss of vehicle	[]	[]	[]	[5eb0e4b5b6c3bb0006eeb1e1]	5e9e4502f5090995de566f86	True	[{'time': 33, 'altitude': None, 'reason': 'merlin engine failure'}]	1	FalconSat	2006-03-24T22:30:00.000Z	1143239400
1	None	NaN	False	False	0.0	5e9d0d95eda69955f709d1eb	False	Successful first stage burn and transition to second stage, maximum altitude 289 km, Premature engine shutdown at T+7 min 30 s, Failed to reach orbit, Failed to recover first stage	[]	[]	[]	[5eb0e4b6b6c3bb0006eeb1e2]	5e9e4502f5090995de566f86	True	[{'time': 301, 'altitude': 289, 'reason': 'harmonic oscillation leading to premature engine shutdown'}]	2	DemoSat	2007-03-21T01:10:00.000Z	1174439400
2	None	NaN	False	False	0.0	5e9d0d95eda69955f709d1eb	False	Residual stage 1 thrust led to collision between stage 1 and stage 2	[]	[]	[]	[5eb0e4b6b6c3bb0006eeb1e3, 5eb0e4b6b6c3bb0006eeb1e4]	5e9e4502f5090995de566f86	True	[{'time': 140, 'altitude': 35, 'reason': 'residual stage-1 thrust led to collision between stage 1 and stage 2'}]	3	Trailblazer	2008-08-03T03:34:00.000Z	1217734440
3	2008-09-20T00:00:00.000Z	1.221869e+09	False	False	0.0	5e9d0d95eda69955f709d1eb	True	Ratsat was carried to orbit on the first successful orbital launch of any privately funded and developed, liquid-propelled carrier	[]	[]	[]	[5eb0e4b7b6c3bb0006eeb1e5]	5e9e4502f5090995de566f86	True	[]	4	RatSat	2008-09-28T23:15:00.000Z	1222643700

Web scraping Falcon 9 Launch records

2020 [edit]

In late 2019, Gwynne Shotwell stated that SpaceX hoped for as many as 24 launches for Starlink satellites in 2020,[490] in addition to 14 or 15 non-Starlink launches. At 26 launches, 13 of which for Starlink satellites, Falcon 9 had its most prolific year, and Falcon rockets were second-most prolific rocket family of 2020, only behind China's Long March rocket family.[491]

[hide] Flight No.	Date and time (UTC)	Version, Booster[R]	Launch site	Payload[I]	Payload mass	Orbit	Customer	Launch outcome	Booster landing
78	7 January 2020, 02:19:21[492]	F9 B5 △ B1049.4	CCAFS, SLC-40	Starlink 2 v1.0 (60 satellites)	15,600 kg (34,400 lb)[R]	LEO	SpaceX	Success	Success (drone ship)
	Third large batch and second operational flight of Starlink constellation. One of the 60 satellites included a test coating to make the satellite less reflective, and thus less likely to interfere with ground-based astronomical observations.[493]								
79	19 January 2020, 15:30[494]	F9 B5 △ B1048.4	KSC, LC-39A	Crew Dragon in-flight abort test[495] (Dragon C205.1)	12,050 kg (26,570 lb)	Sub-orbital[496]	NASA (CTS)[497]	Success	No attempt
	An atmospheric test of the Dragon 2 abort system after Max Q. The capsule fired its SuperDraco engines, reached an apogee of 42 km (26 mi), deployed parachutes after reentry, and splashed down in the ocean 31 km (19 mi) downrange from the launch site. The test was previously slated to be accomplished with the Crew Dragon Demo-1 capsule,[498] but that test article exploded during a ground test of SuperDraco engines on 20 April 2019.[499] The abort test used the capsule originally intended for the first crewed flight.[500] As expected, the booster was destroyed by aerodynamic forces after the capsule aborted.[501] First flight of a Falcon 9 with only one functional stage — the second stage had a mass simulator in place of its engine.								
80	29 January 2020, 14:07[502]	F9 B5 △ B1051.3	CCAFS, SLC-40	Starlink 3 v1.0 (60 satellites)	15,600 kg (34,400 lb)[R]	LEO	SpaceX	Success	Success (drone ship)
	Third operational and fourth large batch of Starlink satellites, deployed in a circular 290 km (180 mi) orbit. One of the fairing halves was caught, while the other was fished out of the ocean.[503]								
81	17 February 2020, 15:05[504]	F9 B5 △ B1053.4	CCAFS, SLC-40	Starlink 4 v1.0 (60 satellites)	15,600 kg (34,400 lb)[R]	LEO	SpaceX	Success	Failure (drone ship)
	Fourth operational and fifth large batch of Starlink satellites. Used a new flight profile which deployed into a 212 km x 386 km (132 mi x 240 mi) elliptical orbit instead of launching into a circular orbit and firing the second stage engine twice. The first stage booster failed to land on the drone ship[505] due to incorrect wind data.[506] This was the first time a flight proven booster failed to land.								
82	7 March 2020, 04:50[507]	F9 B5 △ B1059.2	CCAFS, SLC-40	SpaceX CRS-20 (Dragon C112.3 △)	1,977 kg (4,359 lb)[512]	LEO (ISS)	NASA (CRS)	Success	Success (ground pad)
	Last launch of phase 1 of the CRS contract. Carries Bartolomeo, an ESA platform for hosting external payloads onto ISS.[508] Originally scheduled to launch on 2 March 2020, the launch date was pushed back due to a second stage engine failure. SpaceX decided to swap out the second stage instead of replacing the faulty part.[509] It was SpaceX's 50th successful landing of an orbital booster. The third flight of the Dragon C112 and the last launch of the cargo Dragon spacecraft.								
	18 March 2020, 12:16[510]	F9 B5 △ B1046.5	KSC, LC-39A	Starlink 5 v1.0 (60 satellites)	15,600 kg (34,400 lb)[R]	LEO	SpaceX	Success	Failure (drone ship)

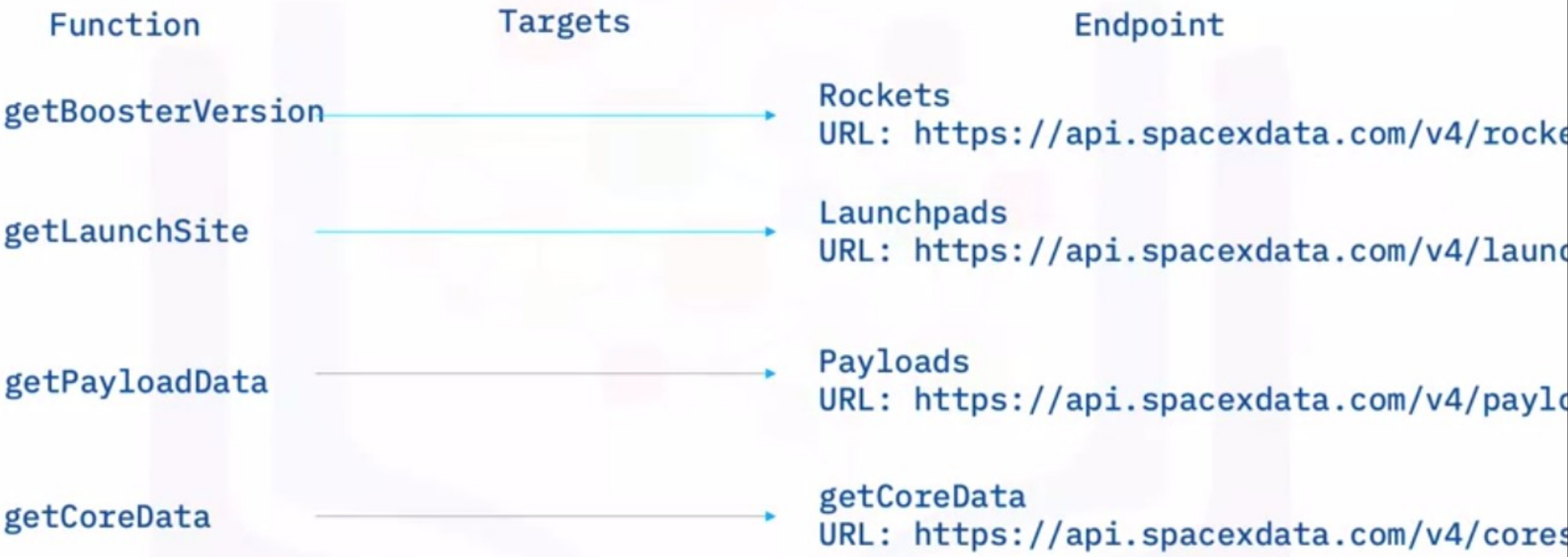
Web scraping with BeautifulSoup

	FlightNumber	Date	BoosterVersion	PayloadMass	Orbit	LaunchSite	Outcome	Flights	GridFins	Reused	Legs	LandingPad	Block	ReusedCount	Serial	Longitude	Latitude
0	1	2006-03-24	Falcon 1	20.0	LEO	Kwajalein Atoll	None None	1	False	False	False	None	NaN	0	Merlin1A	167.743129	9.047721
1	2	2007-03-21	Falcon 1	NaN	LEO	Kwajalein Atoll	None None	1	False	False	False	None	NaN	0	Merlin2A	167.743129	9.047721
2	4	2008-09-28	Falcon 1	165.0	LEO	Kwajalein Atoll	None None	1	False	False	False	None	NaN	0	Merlin2C	167.743129	9.047721
3	5	2009-07-13	Falcon 1	200.0	LEO	Kwajalein Atoll	None None	1	False	False	False	None	NaN	0	Merlin3C	167.743129	9.047721
4	6	2010-06-04	Falcon 9	NaN	LEO	CCAFS SLC 40	None None	1	False	False	False	None	1.0	0	B0003	-80.577366	28.561857

Data Wrangling Problems

- Wrangling Data using an API
- Sampling Data
- Dealing with Nulls

Wrangling Data using an API



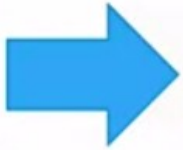
Sampling Data

	FlightNumber	Date	BoosterVersion	PayloadMass	Orbit	LaunchSite	Outcome	Flights	GridFins	Reused	Legs	LandingPad	Block	ReusedCount	Serial	Longitude	Latitude
0	1	2006-03-24	Falcon 1	20.0	LEO	Kwajalein Atoll	None None	1	False	False	False	None	NaN	0	Merlin1A	167.743129	9.047721
1	2	2007-03-21	Falcon 1	NaN	LEO	Kwajalein Atoll	None None	1	False	False	False	None	NaN	0	Merlin2A	167.743129	9.047721
2	4	2008-09-28	Falcon 1	165.0	LEO	Kwajalein Atoll	None None	1	False	False	False	None	NaN	0	Merlin2C	167.743129	9.047721
3	5	2009-07-13	Falcon 1	200.0	LEO	Kwajalein Atoll	None None	1	False	False	False	None	NaN	0	Merlin3C	167.743129	9.047721
4	6	2010-06-04	Falcon 9	NaN	LEO	CCAFS SLC 40	None None	1	False	False	False	None	1.0	0	B0003	-80.577366	28.561857

Dealing with Nulls

```
data_falcon9.isnull().sum()
```

```
FlightNumber        0
Date                0
BoosterVersion      0
PayloadMass         5
Orbit               0
LaunchSite          0
Outcome             0
Flights             0
GridFins            0
Reused              0
Legs                0
LandingPad         26
Block               0
ReusedCount         0
Serial              0
Longitude           0
Latitude            0
dtype: int64
```



```
data_falcon9.isnull().sum()
```

```
FlightNumber        0
Date                0
BoosterVersion      0
PayloadMass         0
Orbit               0
LaunchSite          0
Outcome             0
Flights             0
GridFins            0
Reused              0
Legs                0
LandingPad         26
Block               0
ReusedCount         0
Serial              0
Longitude           0
Latitude            0
dtype: int64
```

Hands-on Lab: Complete the Data Collection API Lab

This environment is to do the Peer Graded Assignment.

In case you need to download the lab notebook (.ipynb file) click HERE to download the lab notebook.

Once you **complete the lab** you can download the notebook as follows:

- Select the notebook which is displayed in the left **Navigation pane.**
- Right click on it and click on the **Download** option.
- Your notebook gets downloaded.

Later upload to GitHub by following the instructions in the reading Getting Started with GitHub .

Further in the **MySubmission tab** of the assignment paste the GitHub link of the notebook in the **URL textbox**.

This course uses a third-party app, Hands-on Lab: Complete the Data Collection API Lab, to enhance your learning experience. The app will

Hands-on Lab: Complete the Data Collection with Web Scraping lab

This environment is to do the Peer Graded Assignment.

In case you need to download the lab notebook (.ipynb file) click HERE to download the lab notebook.

Once you **complete the lab** you can download the notebook as follows:

- Select the notebook which is displayed in the left **Navigation pane.**
- Right click on it and click on the **Download** option.
- Your notebook gets downloaded.

Later upload to GitHub by following the instructions in the reading Getting Started with GitHub .

Further in the **MySubmission tab** of the assignment paste the GitHub link of the notebook in the **URL textbox**.

This course uses a third-party app, Hands-on Lab: Complete the Data Collection with Web Scraping lab, to enhance your learning experience. The app will reference basic information like your name, email, and Coursera ID.

Congratulations! You passed!

Grade received 100% **To pass** 80% or higher

Go to next item

1. Did you Request and parse the SpaceX launch data using the GET request? **1 / 1 point**

- (•) Yes
- ( ) No

Correct

2. Did you filter the dataframe to only include `Falcon 9` launches? **1 / 1 point**

- (•) Yes
- ( ) No

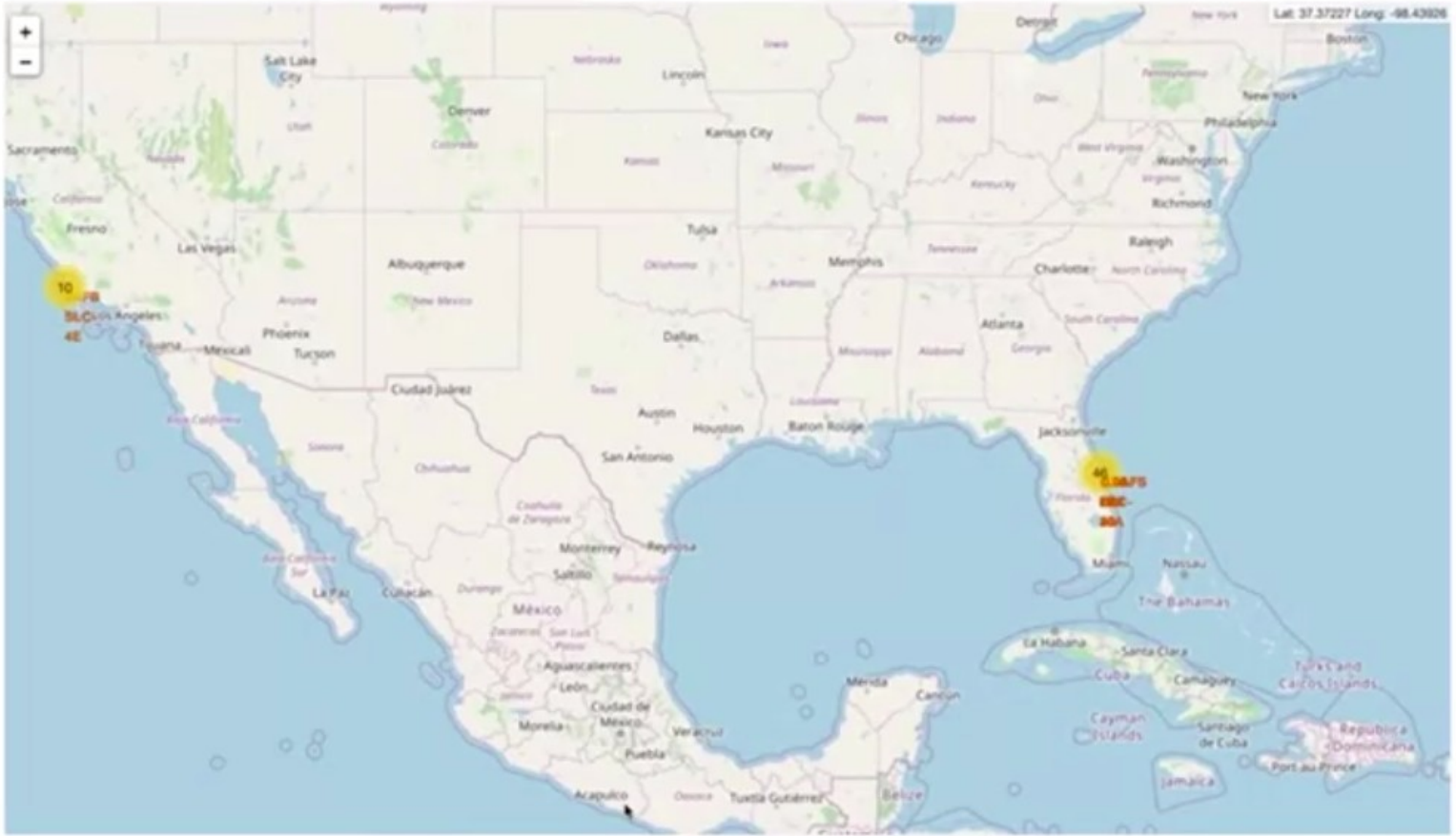
Correct

Data Wrangling

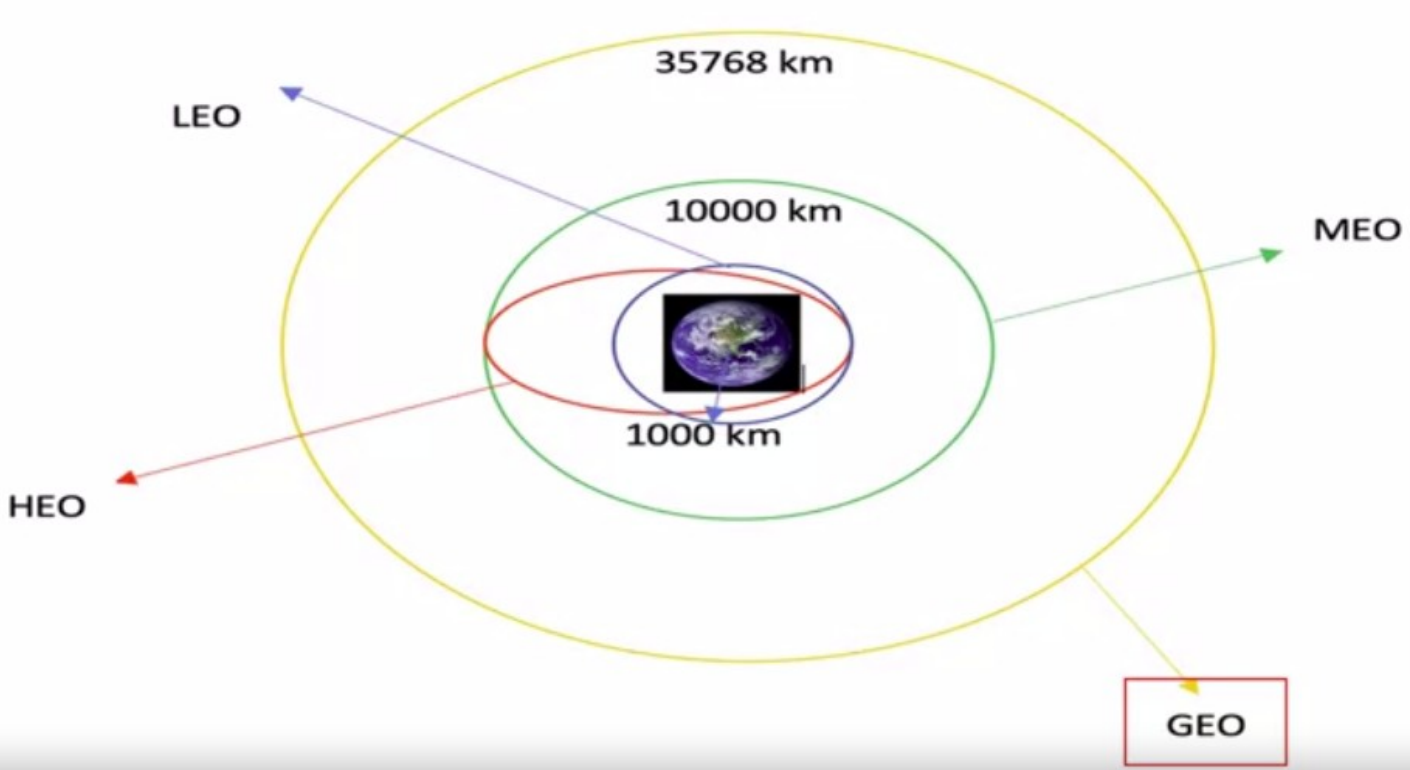
Exploratory Data Analysis

Overview of Dataset

	FlightNumber	Date	BoosterVersion	PayloadMass	Orbit	LaunchSite	Outcome	Flights	GridFins	Reused	Legs	LandingPad	Block	ReusedCount	Serial	Longitude	Latitude
0	1	2010-06-04	Falcon 9	6104.959412	LEO	CCAFS SLC 40	None None	1	False	False	False	NaN	1.0	0	B0003	-80.577366	28.561857
1	2	2012-05-22	Falcon 9	525.000000	LEO	CCAFS SLC 40	None None	1	False	False	False	NaN	1.0	0	B0005	-80.577366	28.561857
2	3	2013-03-01	Falcon 9	677.000000	ISS	CCAFS SLC 40	None None	1	False	False	False	NaN	1.0	0	B0007	-80.577366	28.561857
3	4	2013-09-29	Falcon 9	500.000000	PO	VAFB SLC 4E	False Ocean	1	False	False	False	NaN	1.0	0	B1003	-120.610829	34.632093
4	5	2013-12-03	Falcon 9	3170.000000	GTO	CCAFS SLC 40	None None	1	False	False	False	NaN	1.0	0	B1004	-80.577366	28.561857
5	6	2014-01-06	Falcon 9	3325.000000	GTO	CCAFS SLC 40	None None	1	False	False	False	NaN	1.0	0	B1005	-80.577366	28.561857
6	7	2014-04-18	Falcon 9	2296.000000	ISS	CCAFS SLC 40	True Ocean	1	False	False	True	NaN	1.0	0	B1006	-80.577366	28.561857
7	8	2014-07-14	Falcon 9	1316.000000	LEO	CCAFS SLC 40	True Ocean	1	False	False	True	NaN	1.0	0	B1007	-80.577366	28.561857
8	9	2014-08-05	Falcon 9	4535.000000	GTO	CCAFS SLC 40	None None	1	False	False	False	NaN	1.0	0	B1008	-80.577366	28.561857
9	10	2014-09-07	Falcon 9	4428.000000	GTO	CCAFS SLC 40	None None	1	False	False	False	NaN	1.0	0	B1011	-80.577366	28.561857



Orbit



Outcome

- The column Outcome indicates if the first stage successfully landed

0	True ASDS
1	None None
2	True RTLS
3	False ASDS
4	True Ocean
5	None ASDS
6	False Ocean
7	False RTLS

Source Space X

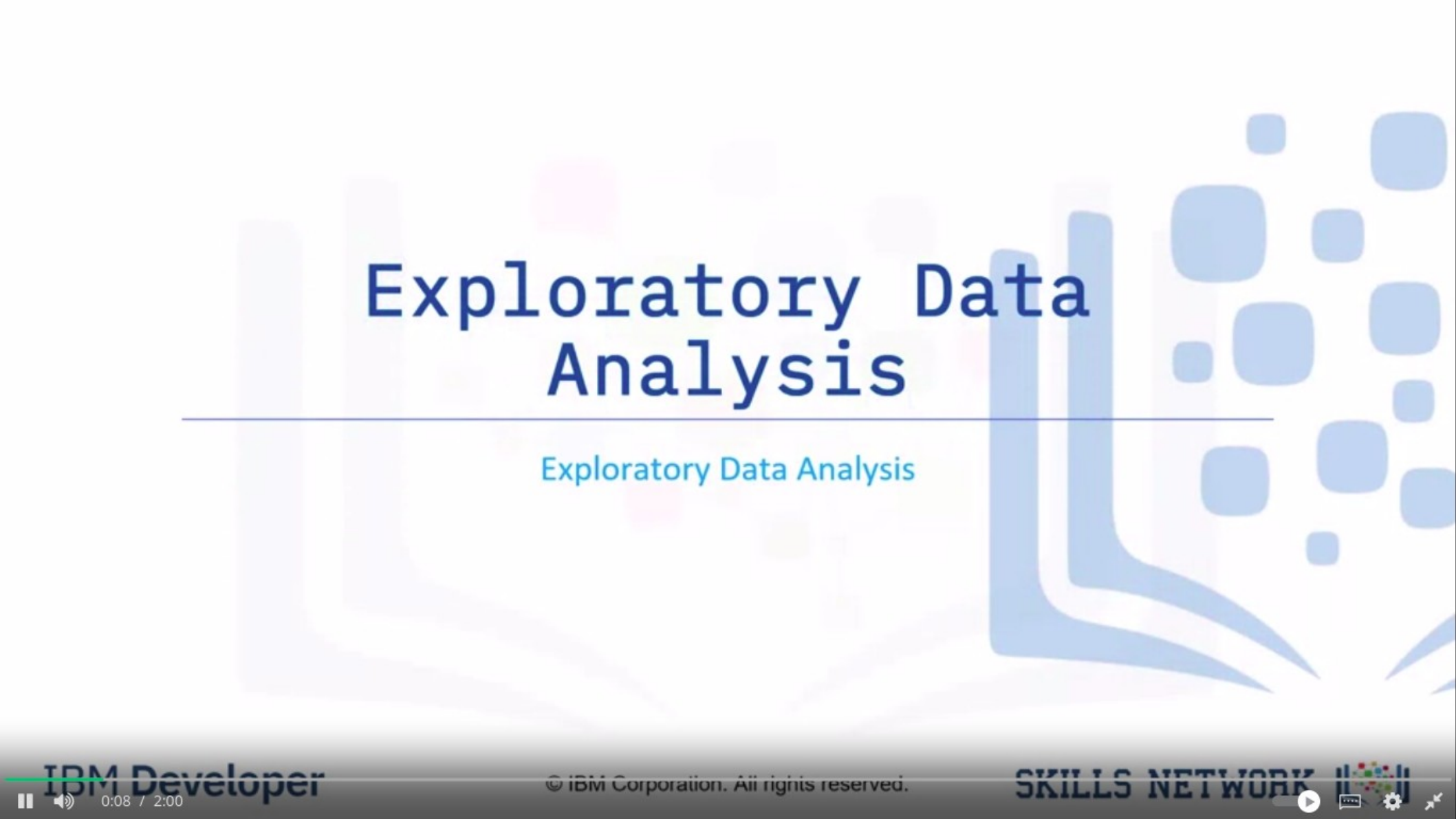
IBM Developer

SKILLS NETWORK

1:37 / 2:11

Outcome

- We would like landing outcomes to be converted to Classes y. (either 0 or 1).
- 0 is a bad outcome i.e., the booster did not land
- 1 is a good outcome i.e., the booster did land


Exploratory Data Analysis
Exploratory Data Analysis
IBM Developer
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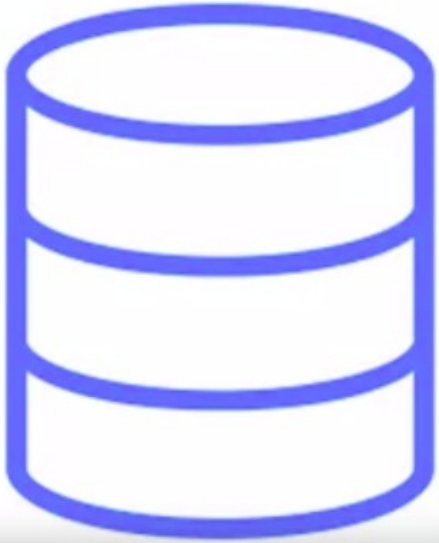
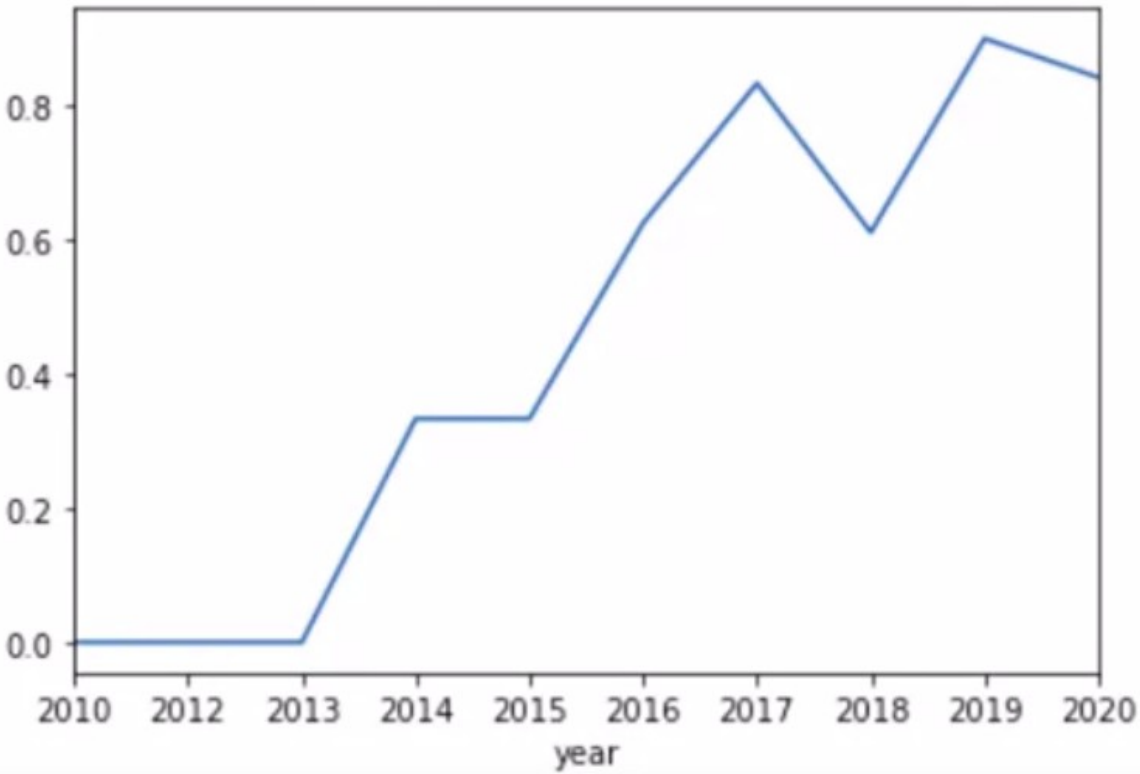
SKILLS NETWORK
0:08 / 2:00

Exploring the Data

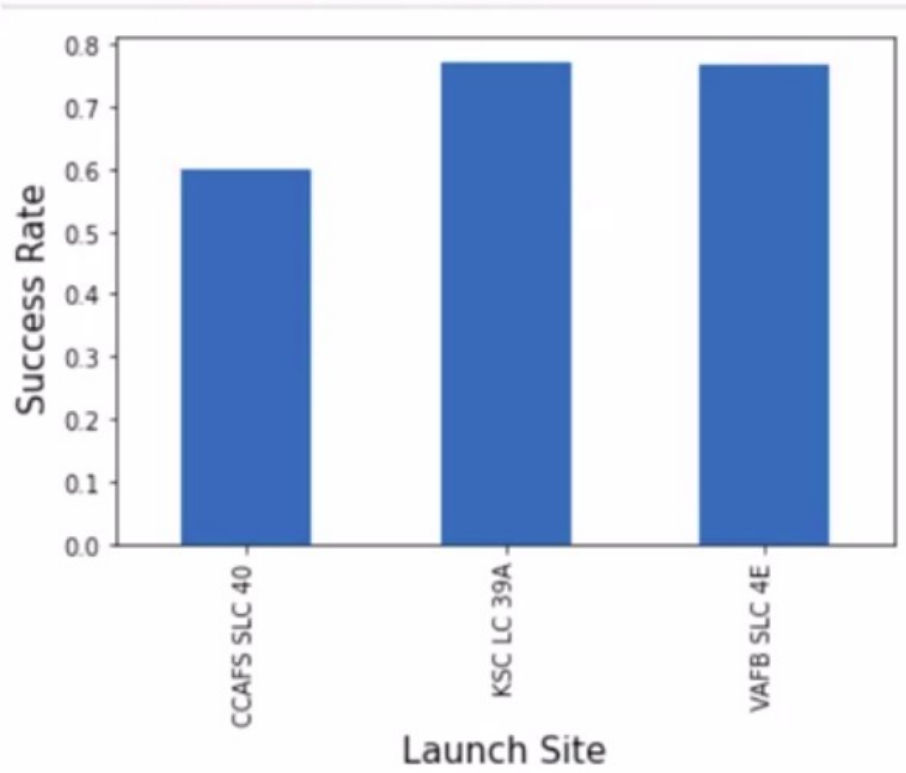
- In the first lab you will perform some Exploratory Data Analysis using a database

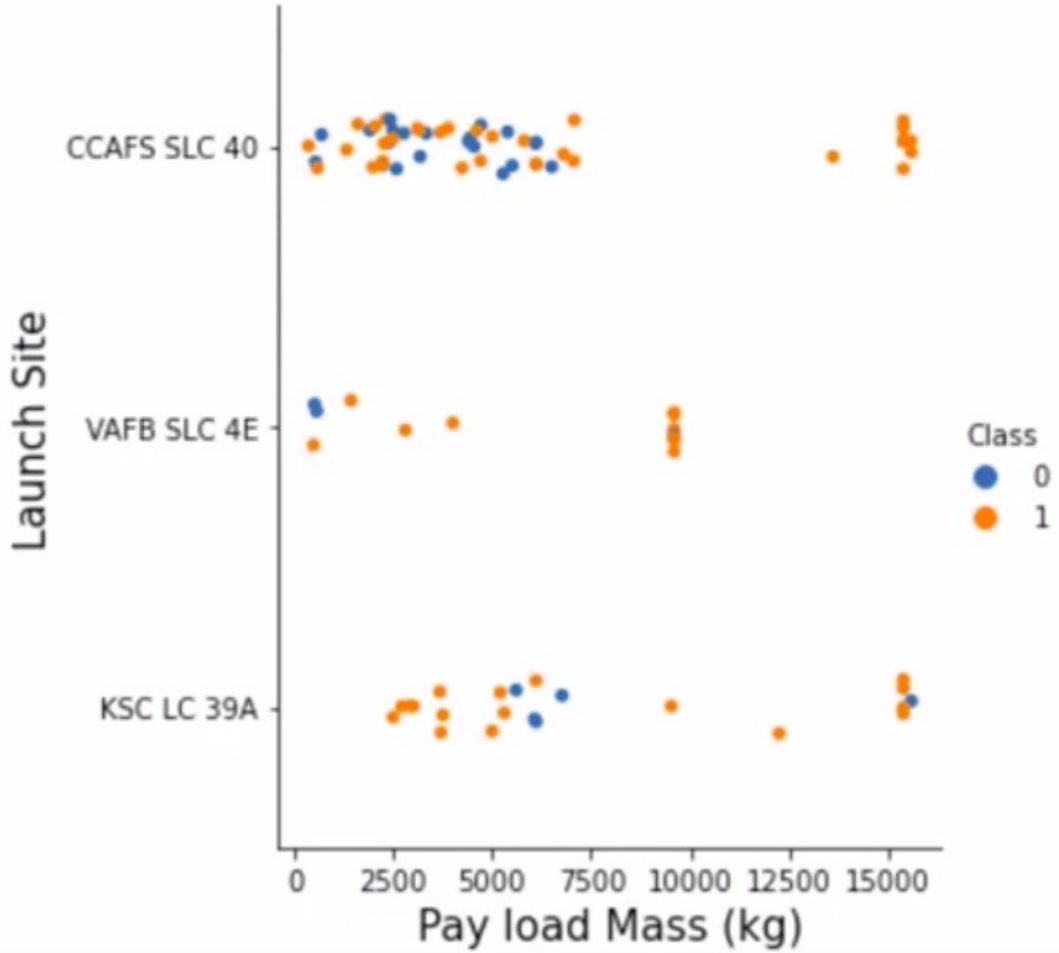


Feature Engineering



Feature Engineering




CCAFS SLC 40
VAFB SLC 4E
KSC LC 39A
Launch Site
0
2500
5000
7500
10000
12500
15000
Pay load Mass (kg)
Class
0
1

	FlightNumber	Date	BoosterVersion	PayloadMass	Orbit	LaunchSite	Outcome	Flights	GridFins	Reused	Legs	LandingPad	Block	ReusedCount	Serial	Longitude	Latitude	Class
0	1	2010-06-04	Falcon 9	6104.959412	LEO	CCAFS SLC 40	None None	1	False	False	False	NaN	1.0	0	B0003	-80.577366	28.561857	0
1	2	2012-05-22	Falcon 9	525.000000	LEO	CCAFS SLC 40	None None	1	False	False	False	NaN	1.0	0	B0005	-80.577366	28.561857	0
2	3	2013-03-01	Falcon 9	677.000000	ISS	CCAFS SLC 40	None None	1	False	False	False	NaN	1.0	0	B0007	-80.577366	28.561857	0
3	4	2013-09-29	Falcon 9	500.000000	PO	VAFB SLC 4E	False Ocean	1	False	False	False	NaN	1.0	0	B1003	-120.610829	34.632093	0
4	5	2013-12-03	Falcon 9	3170.000000	GTO	CCAFS SLC 40	None None	1	False	False	False	NaN	1.0	0	B1004	-80.577366	28.561857	0

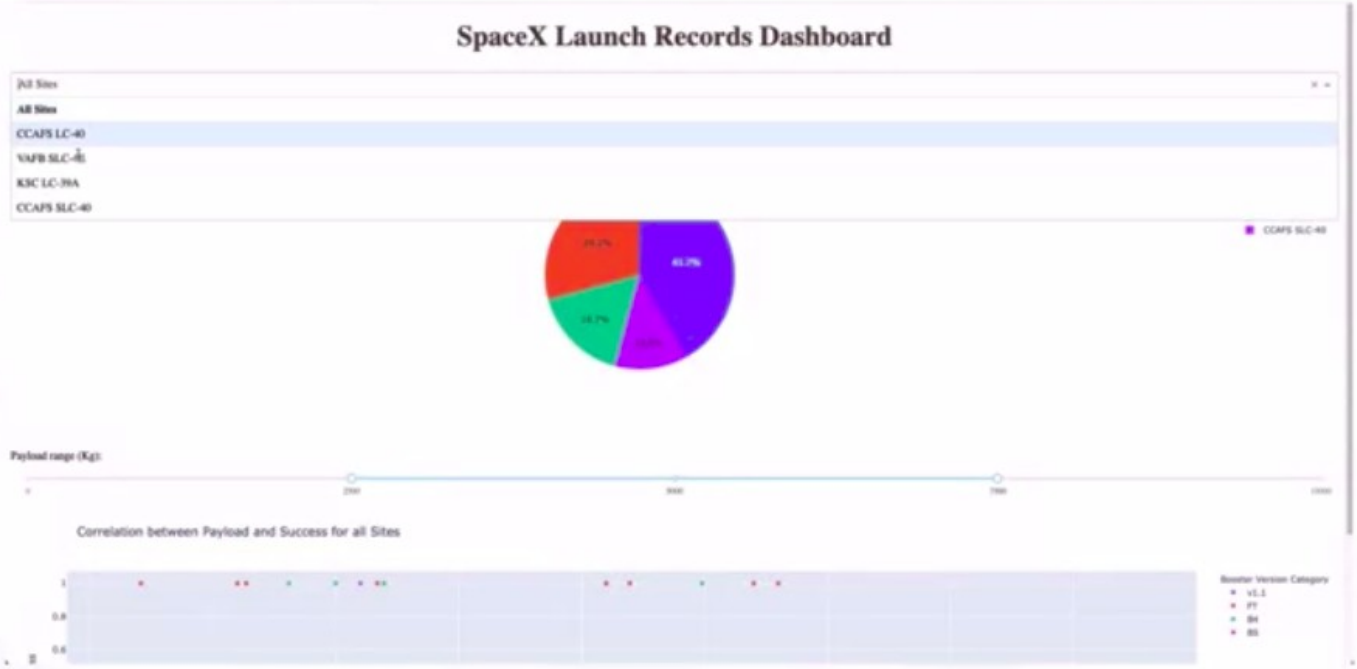
	FlightNumber	PayloadMass	Flights	Block	ReusedCount	Orbit_ES-L1	Orbit_GEO	Orbit_GTO	Orbit_HEO	Orbit_ISS	...	Serial_B1058	Serial_B1059	Serial_B1060	Serial_B1062	GridFins_False	GridFins_True	Reused_False	Reused_True	Legs_False	Legs_True
0	1	6104.959412	1	1.0	0	0	0	0	0	0	...	0	0	0	0	1	0	1	0	1	0
1	2	525.000000	1	1.0	0	0	0	0	0	0	...	0	0	0	0	1	0	1	0	1	0
2	3	677.000000	1	1.0	0	0	0	0	0	1	...	0	0	0	0	1	0	1	0	1	0
3	4	500.000000	1	1.0	0	0	0	0	0	0	...	0	0	0	0	1	0	1	0	1	0
4	5	3170.000000	1	1.0	0	0	0	1	0	0	...	0	0	0	0	1	0	1	0	1	0

5 rows × 83 columns

Interactive Visual Analytics and Dashboard

Interactive Visual Analytics

- Enable direct data exploration and analytics
- Zoom-in/out, Pan, Filter, Search, Link, etc.
- Identify patterns faster and more effectively
- More appealing stories



Analyze Launch Site Geo Data with Folium

- Mark the locations and proximities of launch sites

- Discover patterns via exploring the map

- Explain how to choose an optimal launch site locations

Build a Dashboard with Plotly Dash

- Build a dashboard with dropdown list, range slider, and graphs

- Obtain insights by using the dashboard

Predictive Analysis

SpaceX Falcon 9 Landing Prediction

Build a Machine Learning Pipeline

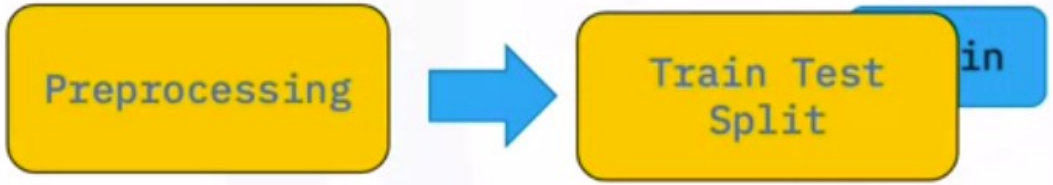
- Predict whether first stage of Falcon 9 will land successfully

Preprocessing

```
from sklearn import preprocessing
```

Build a Machine Learning Pipeline

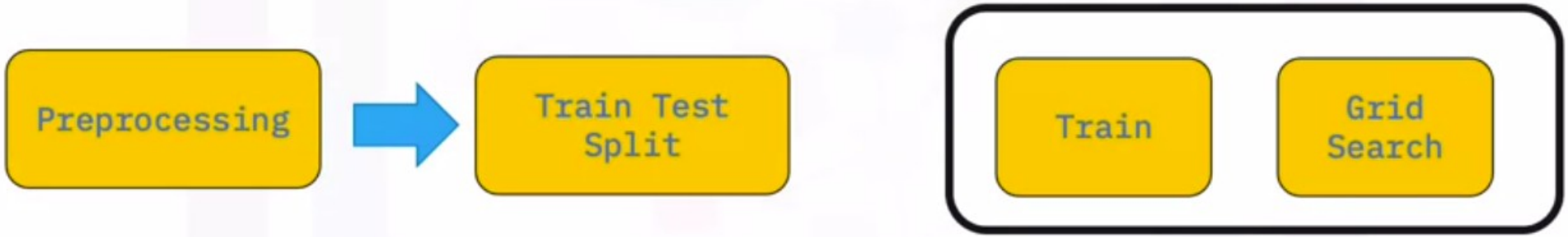
- Predict whether first stage of Falcon 9 will land successfully




```
from sklearn.model_selection import train_test_split
```

Build a Machine Learning Pipeline

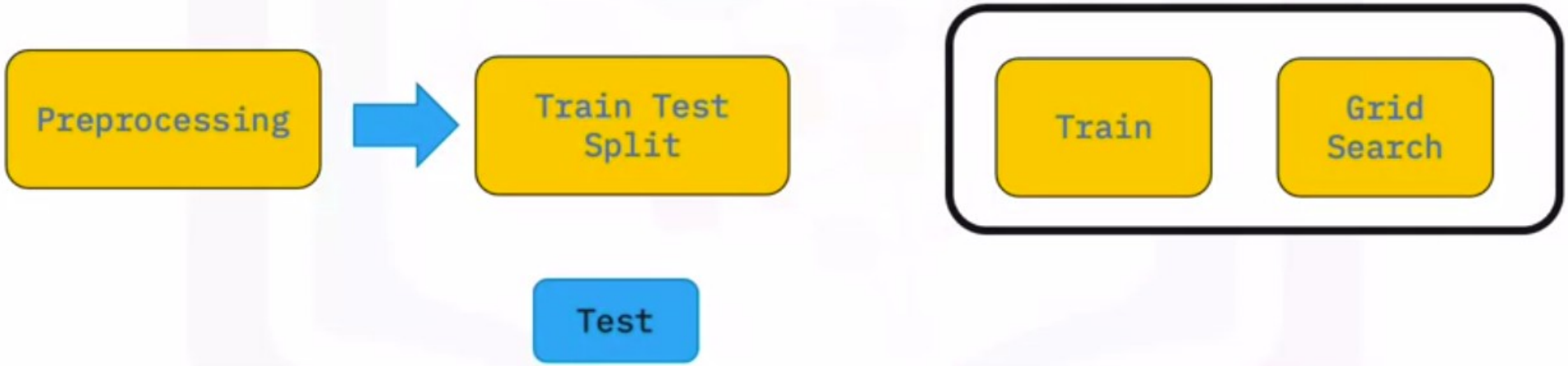
- Predict whether first stage of Falcon 9 will land successfully




```
from sklearn.model_selection import GridSearchCV
```

Build a Machine Learning Pipeline

- Predict whether first stage of Falcon 9 will land successfully

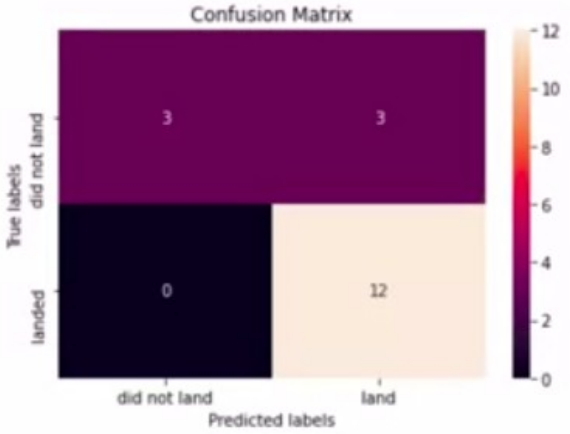



```
from sklearn.model_selection import GridSearchCV
```

Determine Model with Best Accuracy

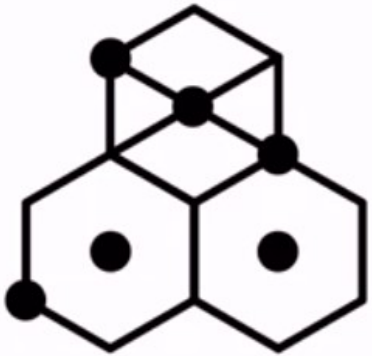
Test

Model
Logistic Regression
Support Vector Machine
Decision Tree Classifier
K-nearest Neighbors



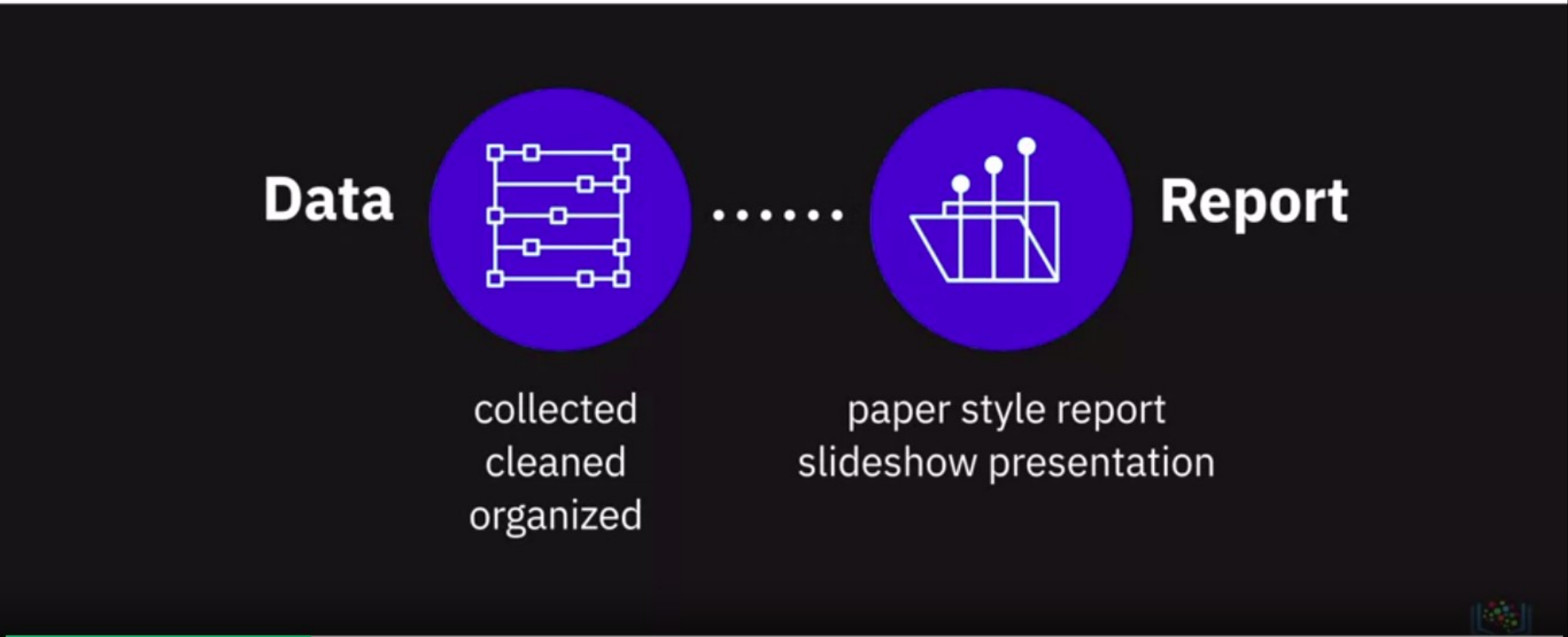
Introduction

finding and
cleaning data

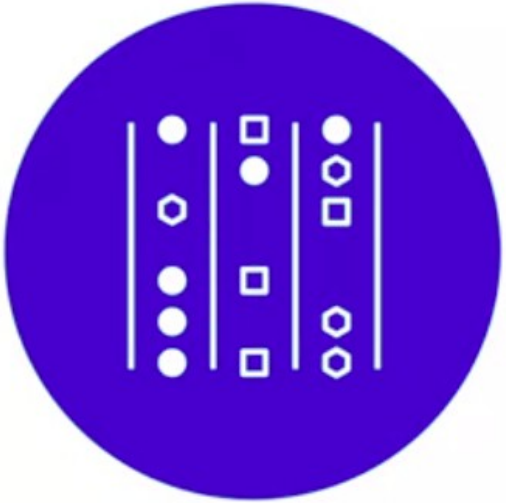


organize and
represent the findings

Find the answers



Elements of a data findings report



Findings Report

Elements of a data findings report

Outline

Elements of a data findings report

- Cover Page
- Executive Summary
- Table of Contents
- Introduction
- Methodology
- Results
- Discussion
- Conclusion
- Appendix

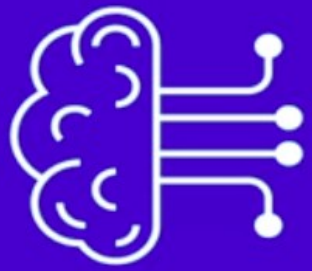
Executive Summary

- Briefly explain the details
- Considered a stand-alone document

Introduction

- Nature of the analysis
- States the problem
- States questions for analysis

Methodology

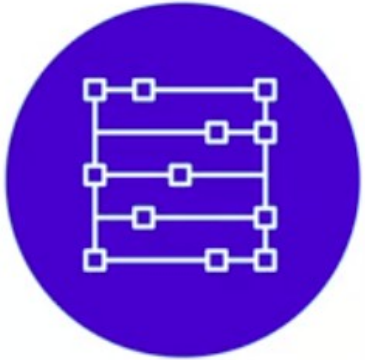


explains the data sources

outlines the plan for the collected data

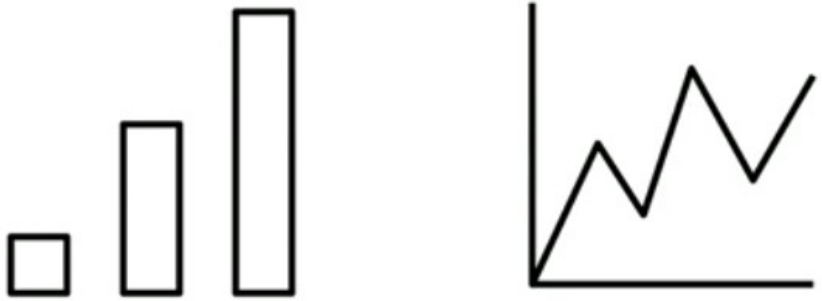
Results

Data



organized
analyzed

Results



Charts and graphs

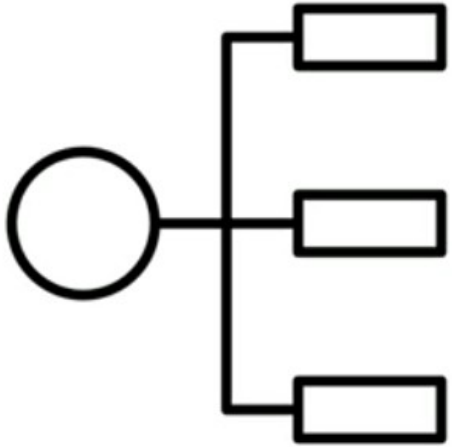
Discussion Findings and Implications

engage the audience

Conclusion

Conclusion of the report findings

Appendix References



Information that didn't fit in the report

Best Practices For Presenting Your Findings

You've spent weeks, maybe months, studying the data and the time has come to report your findings. The questions have been answered, and you feel good about the story. How will you speak to your audience so they leave with the intended message?

In this video, learn how to present your findings in a way that will engage and keep the attention of your audience.

Delivering your message

Factors to remember in accurately conveying your message

- Make sure charts and graphs are not too small, and are clearly labeled
- Use the data only as supporting evidence
- Share only one point from each chart
- Eliminate data that does not support the key message

Delivering your message

Have you ever sat through a presentation and the information being presented was difficult to read or understand?

Image difficult to read

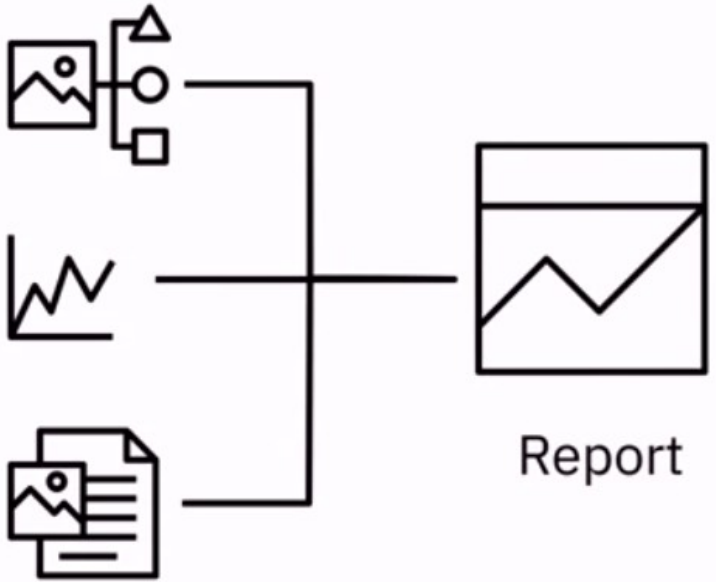
Delivering your message

Have you ever sat through a presentation and the information being presented was difficult to read or understand?

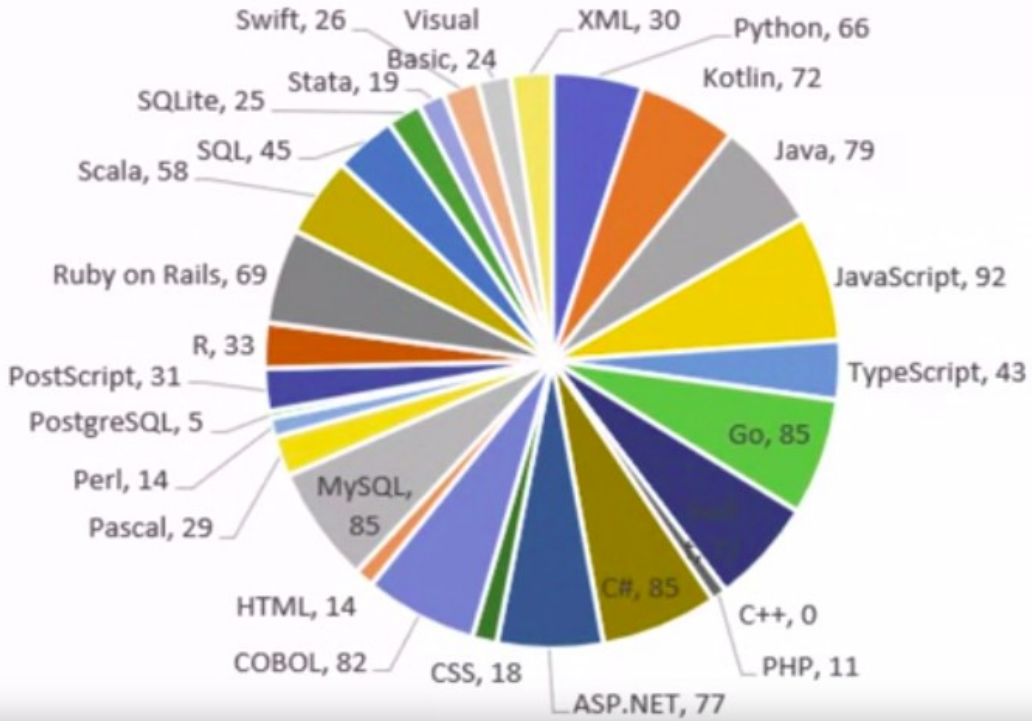
Charts

Labels

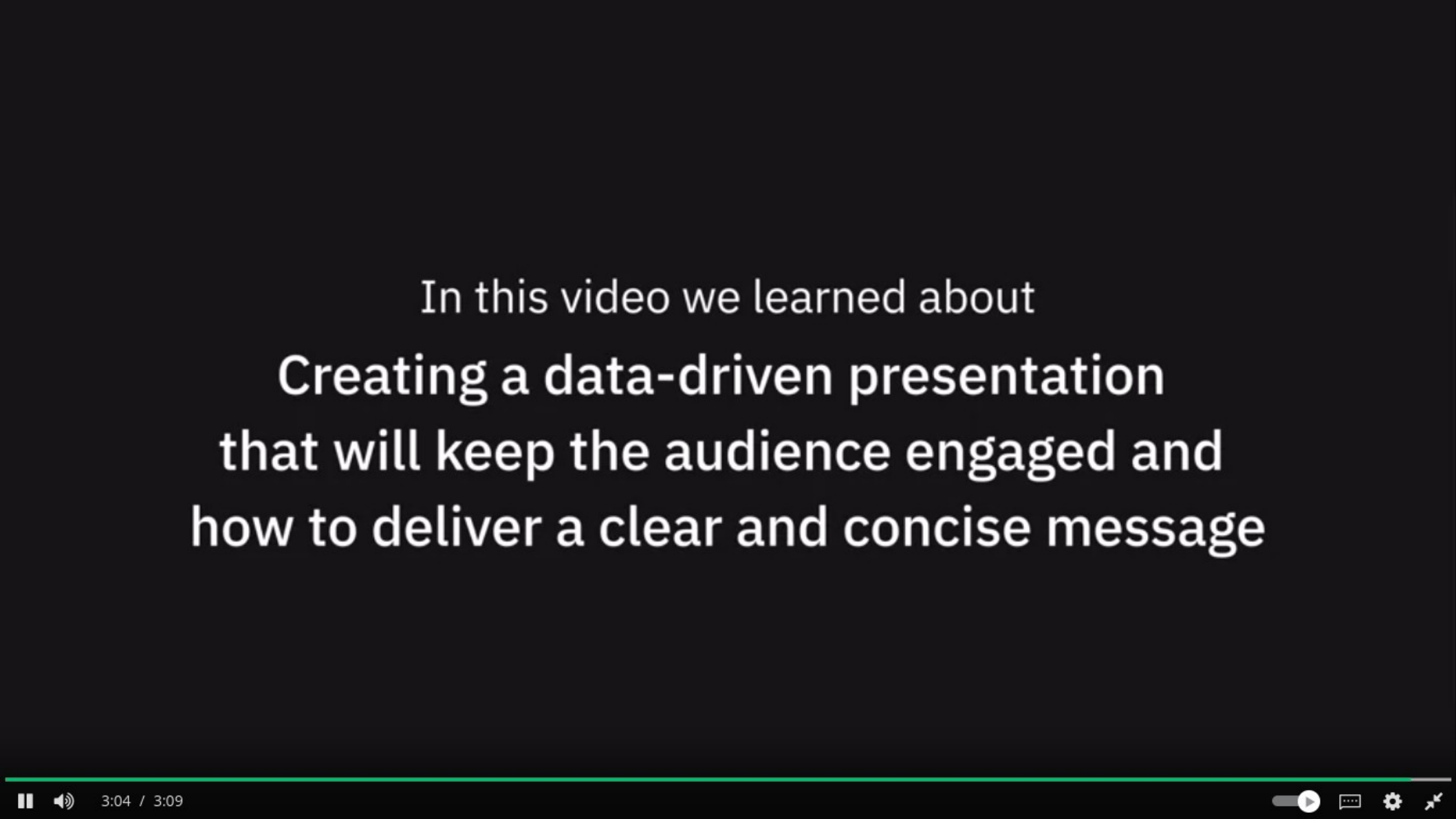
Delivering your message



Delivering your message



Delivering your message


In this video we learned about
Creating a data-driven presentation
that will keep the audience engaged and
how to deliver a clear and concise message
3:04 / 3:09